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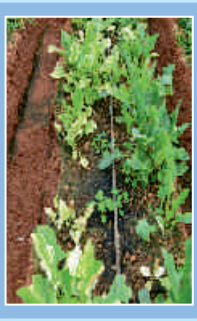

NEMATODE MANAGEMENT IN ORNAMENTAL CROPS




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NEMATODE MANAGEMENT IN ORNAMENTAL CROPS

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Nematode management in Ornamental crops

Flower crops grown in various parts of India are infested by several plant parasitic nematodes. These nematodes attack the root system of the seedlings in nursery beds. Galling of the roots, stunted growth of roots as well as seedlings are the manifestations of nematode damage in the nursery beds. Nematodes such as *Meloidogyne incognita, M. javanica* (root-knot nematodes), *Rotylenchulus reniformis* (reniform nematode), *Heterodera sp.,* (cyst nematodes) are important among the nematodes attacking seedlings of ornamental crops in nursery beds.

Management of nematodes in the nursery beds

Securing healthy seedlings of ornamental crops from the nursery beds is essential to ensure optimum plant population stand, good growth of the crop and higher yields. If nursery beds harbour heavy populations of nematodes, it results in very weak seedlings with poor root growth. Seedlings with stunted root system cannot establish well after transplanting. Nematode attack on the root system makes the seedlings weak and also vulnerable for the infection by secondary pathogens (soil borne fungi and bacteria). Nematode damage also results in the breakdown of resistance against pathogenic fungi and bacteria. Further, nematode infected nursery seedlings facilitate the spread of the nematodes in the main fields making the problem more difficult to manage in a larger area. Because of all these reasons it is inevitable to manage the nematodes in the nursery beds. Almost all the horticultural crops are attacked by either one or more of the above mentioned nematodes.

MANAGEMENT METHODS

Methods for producing the seedlings under poly-house or shade net (protected) conditions

Soil mixture or any substrate prepared by mixing Neem cake @ 50kg + carbofuran or phorate @ 5kg or Neem cake @ 50kg + *Trichoderma harzianum* and *Pseudomonas fluorescens* each at the rate of 2 kg /ton can be used for producing the seedlings of crossandra and China asters.

Methods for producing the seedlings of ornamental crops in the raised nursery beds in open field conditions.

- Apply Neem cake or Pongamia cake or Castor cake @ 500g/sq.m followed by solarization of the nursery beds and leave the raised nursery beds for a period of 20 days.
- Apply carbofuran or phorate @ 50g/sq.m in case where the nematode densities are higher
- Apply formulations of *T. harzianum* / *Pseudomonas fluorescens* and *Paecilomyces lilacinus* (each 50g/sq.m) to the nursery beds along with above mentioned botanicals or chemicals.

After addition of above botanicals, nursery beds have to be watered at 4 day interval for proper decomposition. At least 15 days are required for complete decomposition of these botanicals and hence a fortnight before sowing the seeds, nursery bed soil has to be incorporated with botanicals and bio-pesticides.

The solution: IIHR, Bengaluru has developed mass production protocols of *Pseudomonas fluorescens* 1% W. P. (an effective bio-bactericide and also has nematicidal properties), *Trichoderma harzianum* 1% W. P. & *Trichoderma viride* 1.5 % W. P. (effective bio-fungicides and also have nematicidal properties), *Paecilomyces lilacinus* 1% W. P. and *Pochonia chlamydosporia* 1 % W. P. (effective bio- nematicides). These bio-pesticide formulations to manage nematodes in horticultural crops have also been patented.

Patented Innovation: Arka – Organic Plant Growth Promoter and Yield Enhancer is the bio-pesticide developed by IIHR, Bengaluru. It is an organic formulation, consists of *Pseudomonas fluorescens* and *Trichoderma harzianum*. Patents from 4 countries were granted for this innovation. United States (US) patent – No: US 7,923,005 B, Australian patent – No. AU 2007216174 B2, Indian patent - No.250779 and Thailand patent – No. 7621, (Innovators: Dr. M. S. Rao, Principal Scientist, Division of Entomology & Nematology, & Dr. N. Ramachandran, Former Principal Scientist and Head, Division of Pathology, IIHR, Bengaluru).

Method of seed treatment with the IIHR patented organic formulation of bio-agents:

- ✓ This formulation can be used as a seed treatment or seed dressing agent.
- ✓ Dosage – 15 to 20g of formulation / kg of seed.

Method of substrate treatment with IIHR patented formulation of bio-agents:

- ✓ This formulation can be used for treatment of coco-peat (substrate) in which seedlings are grown under shade net or protected conditions.
- ✓ Dosage – 5 to 10g of formulation/kg of coco-peat (substrate).

Substrate treatment with the bio-agents

Method of soil treatment in raised nursery beds with IIHR patented formulation of bio-agents

- ✓ This formulation can be used for treatment of soil (substrate) in raised beds in which seedlings are grown in open field conditions.
- ✓ Dosage – 50 to 100g formulation / m^2.

Raised nursery beds enriched with IIHR patented organic formulation of bio-agents.

Management of Nematodes on ornamentals in open fields:

Crossandra, China asters, Gladioli, Gerbera and Tuberose when cultivated in open field conditions also are attacked by various nematodes (root-knot nematode - *Meloidogyne incognita*) and reniform nematode – *Rotylenchulus reniformis*) and fungal or bacterial pathogens resulting in considerable losses. Use of nematode infected seedlings of transplanted

ornamentals produces inferior quality flowers and affects the crop productivity adversely as the nematodes carried along with the seedlings multiply rapidly in the main field conditions. Non-transplanted ornamentals such as gladioli, gerbera and tuberose sown in nematode infested fields exhibit severe root galling or lesions.

Nematodes feed on root-system and damage the root-system thoroughly. Nematodes make the plant weak and also vulnerable for the infection by secondary pathogens (soil borne pathogenic fungi and bacteria). Nematode damage also results in the breakdown of resistance against pathogenic fungi and bacteria. Nematodes along with these pathogens can cause loss to the tune of 20 – 50% in these crops.

Nematode management Solutions:

Research conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru for the last 15 years to come out with an alternate technology for chemical pesticides, which are costly and are also hazardous to human health and environment, resulted in developing the technology of management of nematodes using various bio-pesticides.

Protocols for mass production of *Pseudomonas fluorescens* 1% W. P. (an effective bio-bactericide and also has nematicidal properties), *Trichoderma harzianum* 1% W. P. & *Trichoderma viride* 1.5 % W. P. (effective bio-fungicides and also have nematicidal properties), and *Paecilomyces lilacinus* 1% W. P. & *Pochonia chlamydosporia* 1 % W. P. (effective bio- nematicides) have also been developed by Dr. M. S. Rao. The technology of production of these effective and eco-friendly products have been patented.

Nematode problems in tuberose

Nematode Infected root

Biopesticide Treated

Biopesticide Treated tuberose field

Nematode problems in gladioli

Nematode Infected root

Biopesticide treated gladioli field

Methods of management of nematodes in the main field:

Step 1: Soil application

Land should be thoroughly ploughed and beds are to be prepared after bringing the soil to fine tilth. Add recommended doses of fertilizers. Also add carbofuran or phorate @ 20 – 25 kg + 200g neem / pongamia / mahua cake per acre. Maintain optimum moisture in the beds for proper decomposition of neem / pongamia / mahua cake.

For non-chemical management of nematodes, apply two tons of FYM or 500 kg of neem cake/ pongamia cake or one ton of vermicompost enriched with *Pseudomonas fluorescens* + *Trichoderma harzianum* + *Paecilomyces lilacinus* during the land preparation or on the beds 5 – 10 days before sowing seeds or transplanting the seedlings.

Process of Enrichment of FYM

- One ton of well decomposed FYM has to be enriched by mixing with 2 kg each of *Pseudomonas fluorescens* + *Trichoderma harzianum* + *Paecilomyces lilacinus*. It has to be covered with mulch and optimum moisture of 25 - 30% has to be maintained for a period of 15 days.
- Once in a week thoroughly mix the FYM for maximum multiplication of and homogenous spread of the microorganisms in the entire lot of FYM.

Enrichment of FYM

Process of Enrichment of Neem cake

- 1 ton of neem cake has to be enriched by mixing with 2 kg each of IIHR patented *Pseudomonas fluorescens* + *Trichoderma harzianum* + *Paecilomyces lilacinus*. It has to be covered with mulch and optimum moisture of 25 - 30% has to be maintained for a period of 15 days.
- Once in a week thoroughly mix the neem cake for maximum multiplication of and homogenous spread of the microorganisms in the entire lot of neem cake.

Process of Enrichment of vermicompost

- One ton of vermicompost has to be enriched by mixing with 2 kg each of IIHR patented *Pseudomonas fluorescens* + *Trichoderma harzianum* + *Paecilomyces lilacinus*. It has to be covered with mulch and optimum moisture of 25 - 30% has to be maintained for a period of 15 days.
- Once in a week thoroughly mix the vermicompost for maximum multiplication and homogenous spread of the microorganisms in the entire lot of vermicompost.

Step 2: Spraying:

The IIHR patented organic formulation containing *Pseudomonas fluorescens* and *Trichoderma harzianum* has to be sprayed on the plants at regular intervals of 30 days at a dosage of 5g/ lit or 5ml/ lit.

Step 3: Drenching or application through drip irrigation system:

The IIHR patented organic formulation has to be given through drip/ by drenching @ 5g/ lit or 5ml/ lit at regular interval of 30 days.

Application of the bio-pesticides to a standing crop

It is possible that farmers would not have prepared beds or main field initially as mentioned above and still observe the infestation of nematodes, soil borne pathogenic fungi and bacteria on the crops. Then these following steps for the management of nematodes, soil borne pathogenic fungi and bacteria need to be taken.

Step 1: Soil application:

Apply two tons of FYM or 500 kg of neem cake / pongamia cake or one ton of vermicompost enriched with *Pseudomonas fluorescens* + *Trichoderma harzianum* + *Paecilomyces lilacinus* on the beds around the rhizosphere of the plants.

Step 2: Spraying:

The IIHR patented organic formulation containing *Pseudomonas fluorescens* & *Trichoderma harzianum* has to be sprayed on the plants at regular intervals of 30 days at a dosage of 5g/ lit or 5ml/ lit.

Step 3: Drenching or application through drip irrigation system:

The IIHR patented organic formulation has to be given through drip/ by drenching @ 5g/ lit or 5ml/ lit at regular interval of 30 days.

- By following all these methods farmers can get significant increase in the yield of the crops and the cost benefit ratio will be above 1: 3.

For products or technologies of bio-pesticides - *Pseudomonas fluorescens* 1% W. P., *Trichoderma harzianum* 1% W. P., *Trichoderma viride* 1.5% W. P., *Paecilomyces lilacinus* 1% W. P., *Pochonia chlamydosporia* 1% W. P. and product of patented technology and patented organic formulation please contact:

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